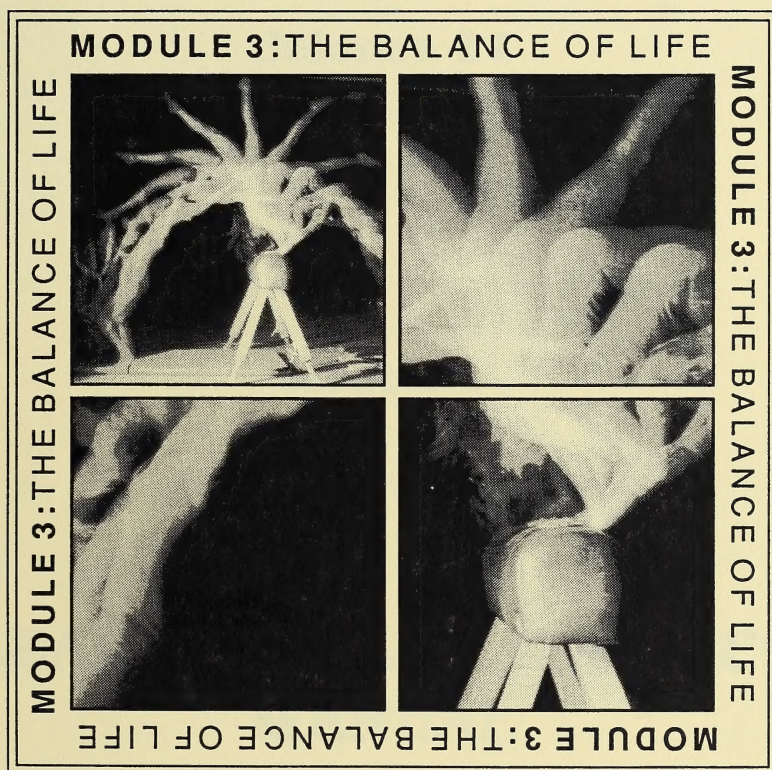


# SCIENCE 14



## Learning Facilitator's Manual



**Distance  
Learning**

**Alberta**  
EDUCATION





# **Science 14**

## **Module 3**

# **LEARNING FACILITATOR'S MANUAL**



**Distance  
Learning**

**Alberta**  
EDUCATION

## Note

This Science Learning Facilitator's Manual contains answers to teacher-assessed assignments; therefore, it should be kept secure by the teacher. Students should not have access to these assignments until they are assigned in a supervised situation. The answers should be stored securely by the teacher at all times.

Science 14  
Learning Facilitator's Manual  
Module 3  
The Balance of Life  
Alberta Distance Learning Centre  
ISBN No. 0-7741-0372-8

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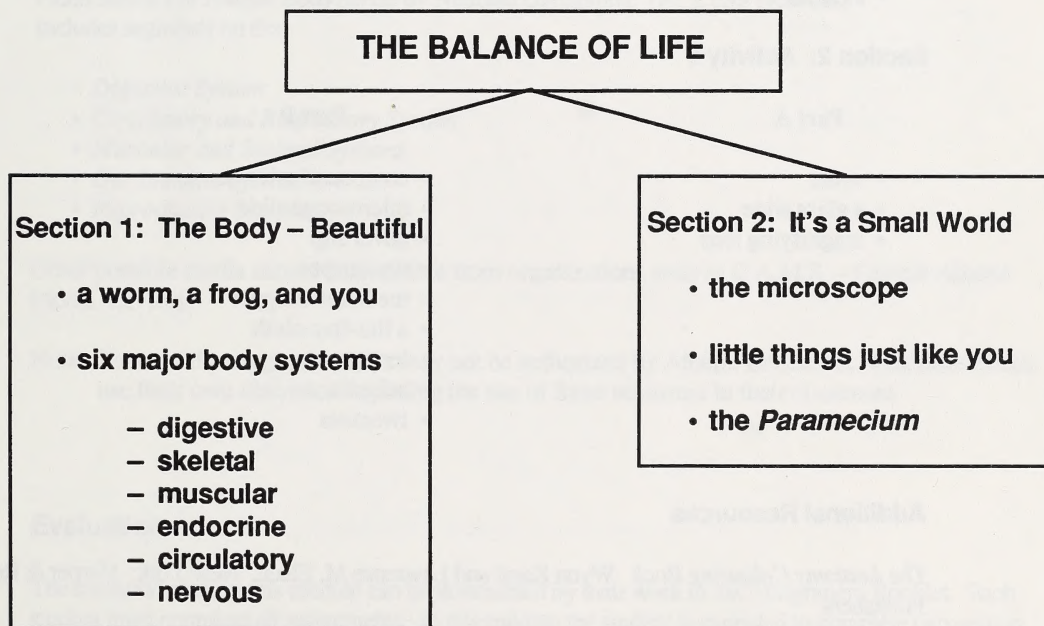
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## Module 3 – The Balance of Life: Overview

The emphasis in this module is on human body systems. The student must review six essential body systems to understand their functions and overall importance in maintaining a healthy individual. After understanding how each body system functions, the student must appreciate how all body systems work together to maintain the body as a whole. The module ends with a comparison of human body systems and the organelles of the *Paramecium*.

The only equipment needed for the lab investigations is a hand lens, a microscope slide, and a compound microscope (optional). The investigations in this module try to use materials which are readily available in the home. Answers are provided for most exercises in the study guide. The only exceptions are the enrichment activities, in which the student is asked to do independent research to investigate topics of interest. Students should submit their enrichment activities to their learning facilitator for confirmation of the assignment.



## Materials You Need

The following is a list of materials necessary to complete the investigations and activities in Module 3.

### Section 1: Activity 2

- one cooked chicken bone (drumstick preferred)
- one cooked chicken wing
- a sharp knife

### Section 1: Activity 4

- a stopwatch or digital watch with a stopwatch function
- a dollar bill (any amount will do, \$2, \$5, \$10, etc.)
- or
- a piece of paper 15 cm (length) by 7 cm (width)
- a friend

### Section 2: Activity 1

#### Part A

- water
- a glass slide
- magnifying lens

#### Part B

- compound microscope
- microscope slide
- cover slip
- newspaper
- medicine dropper
- a lint-free cloth
- lens paper
- scissors
- tweezers

## Additional Resources

*The Anatomy Colouring Book* Wynn Kapit and Lawrence M. Elson. New York: Harper & Row Publishers.

*Applied Science, Book Two* G. Wilde. Melbourne, Australia: Longman Cheshire, 1988.

*The Grays' Anatomy Colouring Book* Matthew DeCaro. Philadelphia: Running Press, 1980.

*Human Physiology* Thomas F. Morrison et. al. Holt, Rinehart, and Winston Publishers, 1977.

*Laboratory Biology – Investigating Living Systems (Canadian SI Edition)* Albert Kasket. Charles E. Merrill Publishing Company.



*Modern Principles of Athletic Training – 6th Edition* Daniel D. Amheim. Toronto: Times Mirror/Mosby College Publishing, 1985.

*Principles of Anatomy and Physiology – 5th Edition* Tortora and Anagnostakos. New York: Harper & Row Publishers, 1987.

*Principles of Science – Book Two* Charles H. Heimler and Charles D. Neal. Charles E. Merrill Publishing Co., 1979.

*Your Body in Balance (ISIS Series)* Glen Hutton. Searborough: Globe/Modern Curriculum Press, 1989.

## Possible Media

Video Man: *The Incredible Machine* (ACCESS Network)

Video Series *The Human Body Series* by National Geographic (ACCESS Network) includes segments on the

- *Digestive System*
- *Circulatory and Respiratory System*
- *Muscular and Skeletal Systems*
- *Our Immune System*
- *Reproductive Systems*

Other possible media should be available from organizations such as C.A.M.S. – Central Alberta Media Services.

Note: Some of the suggested media may not be authorized by Alberta Education. Teachers should use their own discretion regarding the use of these resources in their classroom.

## Evaluation

The students' mark in this module can be determined by their work in the Assignment Booklet. Each student must complete all assignments. In this module the student is expected to complete two section assignments. The assignment breakdown is as follows:

Section 1	=	60 marks
Section 2	=	40 marks
<b>TOTAL</b>	<b>=</b>	<b>100 marks</b>

## Section 1: The Body – Beautiful

The emphasis in this section is on science and its discipline for developing explanations for body functions. Body systems and their functions are explained along with their interrelationships to each other. The material can be augmented with a number of guest speakers such as a doctor or a nurse. The Anatomy Colouring Book\* may be used as a teaching aid. Its diagrams are excellent.

\*See the list of additional resources.

### Section 1: Activity 1

1. Do you think the digestive system of a worm, a frog, and you would be exactly the same? Record your hypothesis along with the reason why you think your hypothesis is correct.

*No, the digestive systems would not be the same because*

- *the animals are different sizes*
- *the animals belong to different species*
- *they possess different levels of complexity*
- *the animals all eat different foods*

2. The digestive system of the earthworm is quite simple.

Food goes in the *mouth*, and waste is excreted through the *anus*. Most of the actual digestion and absorption occurs in the *small intestine*.

3. Do you think your digestive system is as simple as the worm's?

Check the correct answer. ☐ yes ☒ no

*The human digestive system is not as simple as the worm's.*

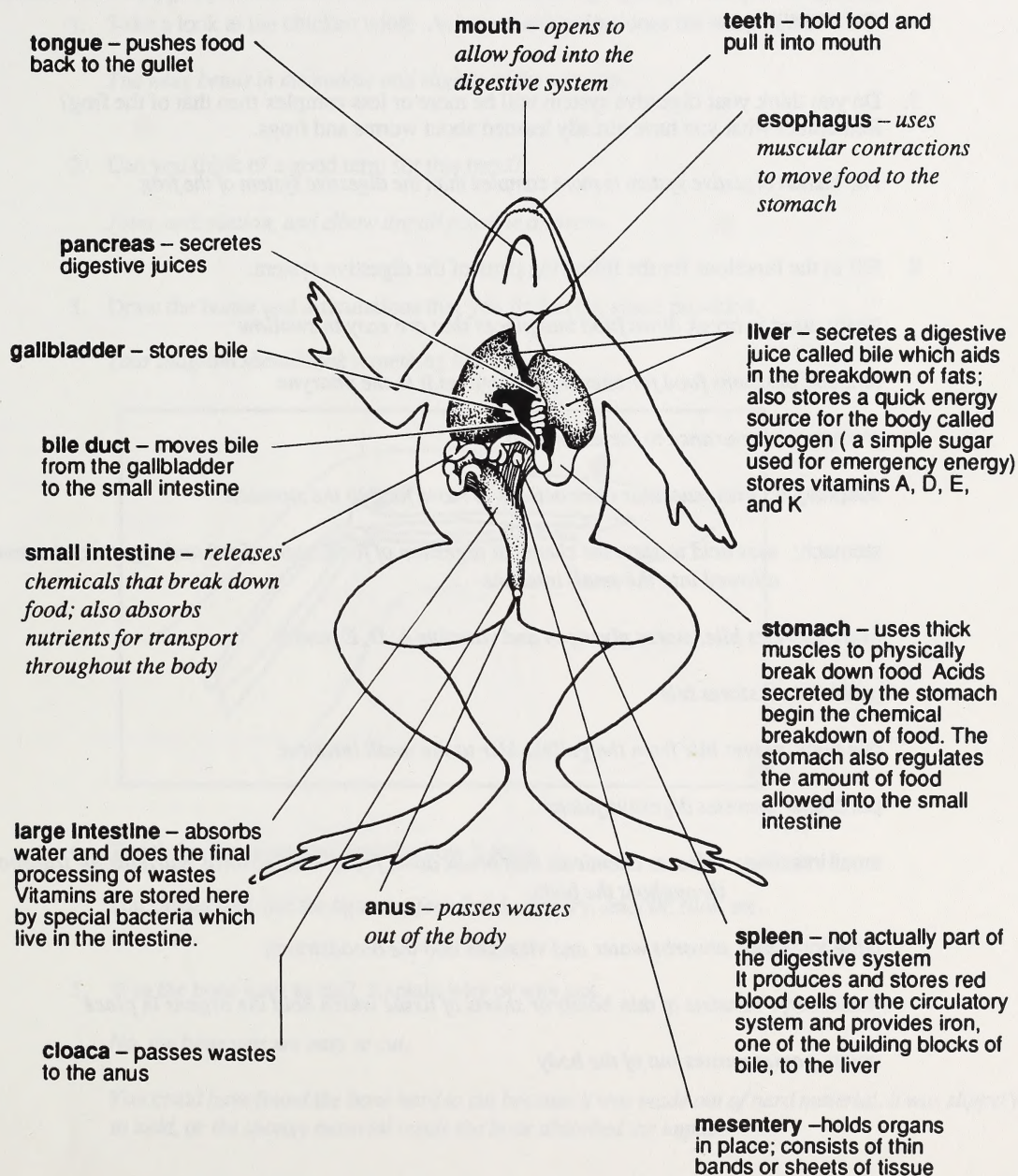
4. Do you think a frog's digestive system is the same as a worm's?

Check the correct answer. ☐ yes ☒ no

*The frog and the worm have different digestive systems.*



5. Fill in the function for the parts of the frog that you already know.



6. As you can see, the frog and the worm have several similar organs. List the organs found in both the frog and the worm.

*The digestive systems of the frog and the worm both have a mouth, an esophagus, a small intestine, and an anus.*

7. Do you think your digestive system will be more or less complex than that of the frog? Remember what you have already learned about worms and frogs.

*The human digestive system is more complex than the digestive system of the frog.*

8. Fill in the functions for the following parts of the digestive system.

teeth: *used to break down food into pieces that are easy to swallow*

tongue: *positions food for chewing and moves it to the pharynx*

pharynx: *the entrance to the esophagus*

esophagus: *uses muscular contractions to move food to the stomach*

stomach: *uses acid to start the chemical digestion of food; stores food and regulates the amounts allowed into the small intestine*

liver: *secretes bile, stores glycogen and vitamins A, D, E, and K*

gallbladder: *stores bile*

bile duct: *moves bile from the gallbladder to the small intestine*

pancreas: *secretes digestive juices*

small intestine: *releases chemicals that break down food; also absorbs nutrients for transport throughout the body*

large intestine: *absorbs water and vitamins into the bloodstream*

mesentery: *consists of thin bands or sheets of tissue which hold the organs in place*

anus: *passes wastes out of the body*



**Section 1: Activity 2****Investigation: Chickens Have Bones, Too!**

1. Take a look at the chicken wing. At how many points does the wing bend?

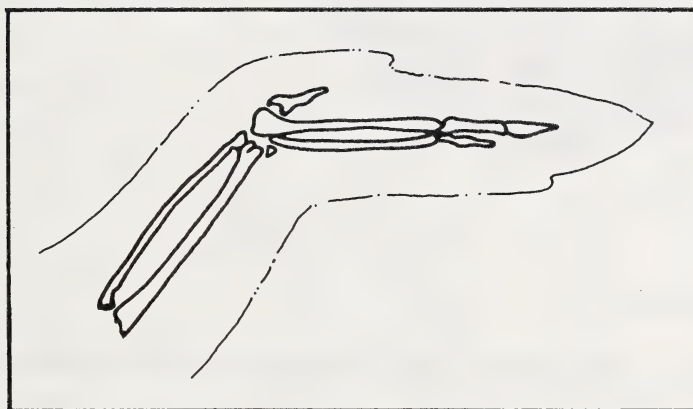
*The wing bends in the middle and slightly at the wing tip.*

2. Can you think of a good term for this bend?

*Joint, articulation, and elbow are all possible answers.*

3. Draw the bones and articulations that you find in the space provided.

*Your diagram should look something like this.*



4. Touch the ligament and describe how it feels.

*You should find that the ligament feels hard, slippery, smooth, slick, etc.*

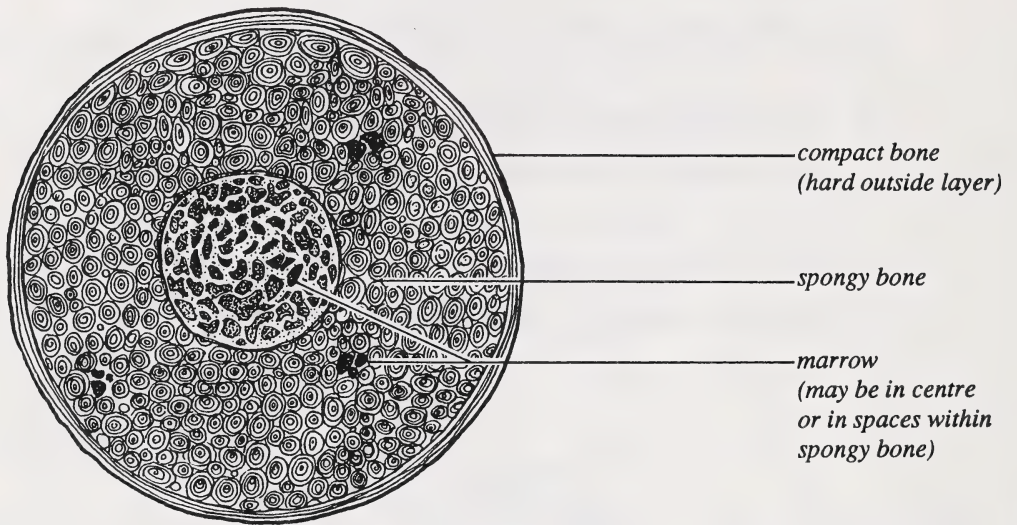
5. Was the bone easy to cut? Explain why or why not.

*No, the bone was not easy to cut.*

*You could have found the bone hard to cut because it was made out of hard material, it was slippery to hold, or the spongy material inside the bone absorbed the impact.*

6. Draw a cross section of the chicken bone in the circle provided. Label each of the three bone types in your diagram.

*cross section of a chicken bone*



### Section 1: Activity 3

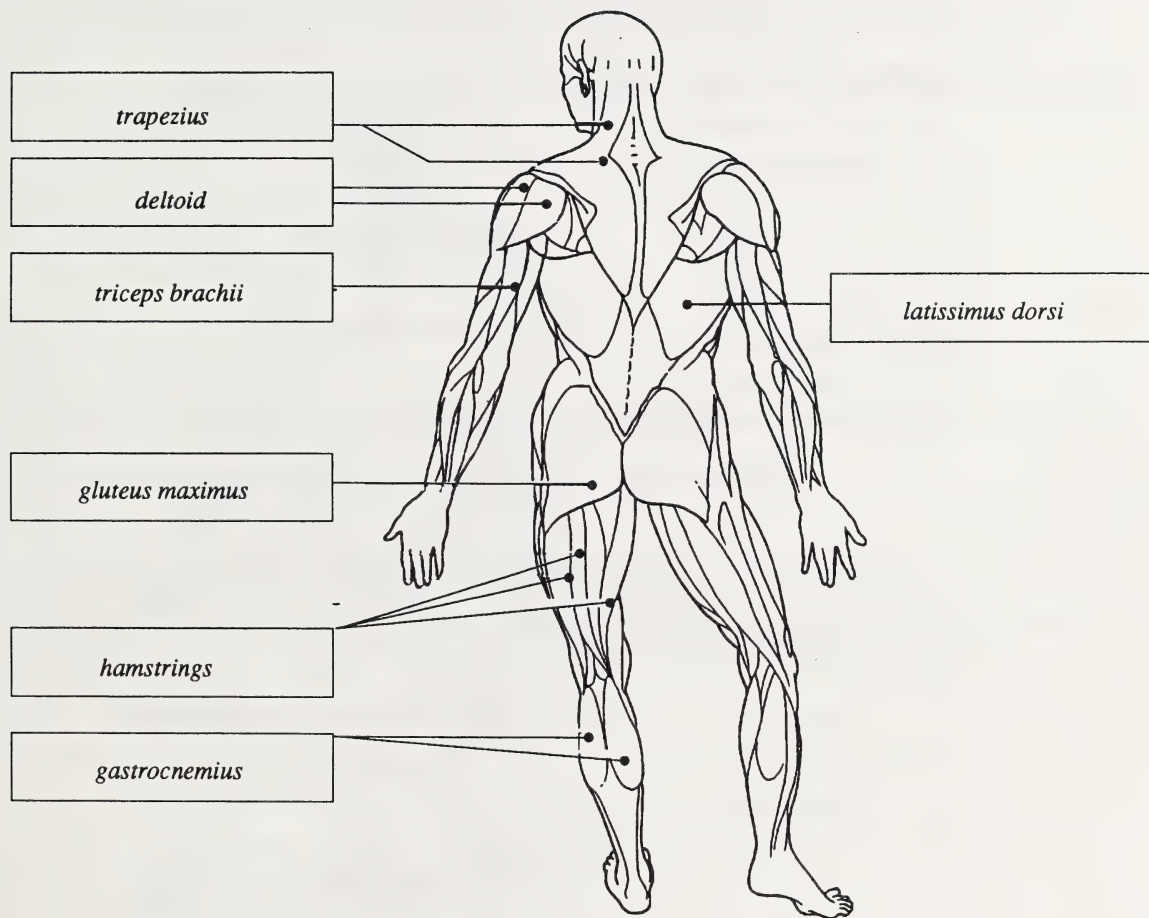
1. Your skeleton is a very important structure in your body, but what is the system that allows you to move that internal framework of bone?

*The muscular system allows you to move the internal framework of bone.*

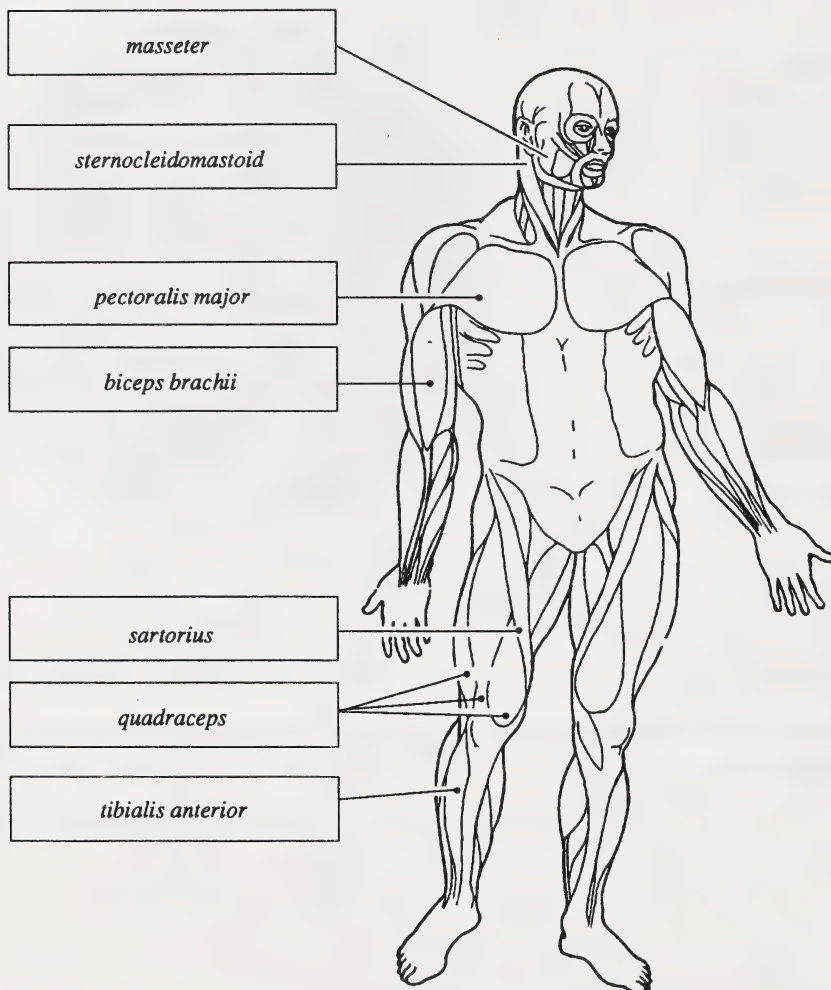


2. Label the muscles in the diagrams which follow. You can use the list of muscles and the functions to help you.

a.



b.





3. Explain how each pair of muscles move a joint.

*Muscles are grouped in pairs around each joint. One muscle contracts to bend a joint, while the other muscle will contract to straighten the joint.*

4. Why is it important to your body to have two muscles crossing each articulation (joint)?

*All of the joints in your body must have muscles working in pairs or you would end up with joints stuck in one position.*

### Section 1: Activity 4

1. Name the body's natural computer.

*The brain is the body's natural computer.*

2. What happens to your lower leg when your friend taps you below the knee?

*Your leg should make a jerking movement, swinging outward.*

3. Explain why your lower leg jumps when you are tapped below the knee.

*The tap on the knee stimulated a nerve which made a muscle contract and the lower leg move.*

### Investigation: Reaction Times

#### Part A: A Control Situation

STEP D	OBSERVATION
<p><i>Your average reaction time should be somewhere between 0.08 seconds (a fast hand speed) and 0.5 seconds (a slow hand speed).</i></p>	

## 4. Did your reaction times

\_\_\_\_\_ increase

☒ decrease

\_\_\_\_\_ stay the same

Check the correct answer.

## 5. How could you explain the result in question 4?

*Your increase in hand speed (a lower reaction time) is probably due to learning and/or repetition of the activity.*

**Part B: An Unexpected Event**

## 6. How many times did you catch the bill? \_\_\_\_\_

*Your number of catches will usually be zero, but there may be times when you do catch the bill. A high number of catches means that you were not doing the exercise properly.*

## 7. Match the organs with the functions given on the right.

  c   skin  e   ear  d   tongue  a   eye  b   nose

a. distinguishes light, dark, and colours and sends the information to the brain

b. detects smells and relays the information to the brain

c. detects heat, cold, pain, and texture and sends the information to the brain

d. detects sweet, salty, sour, and bitter chemicals

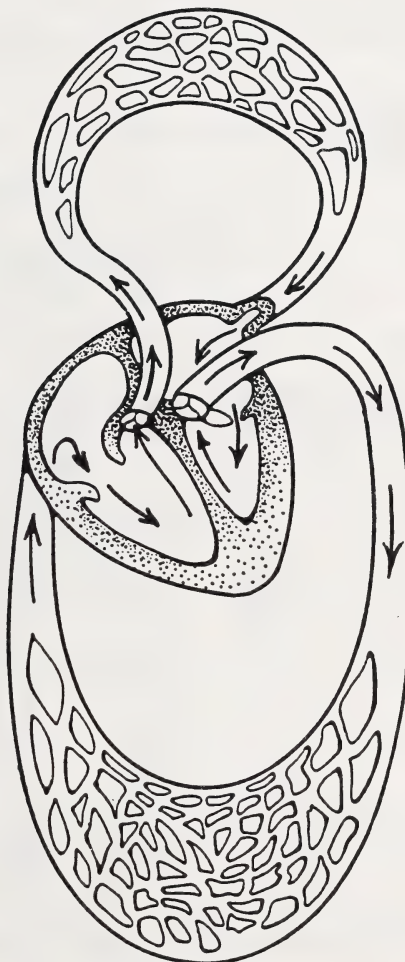
e. receives and transmits sound to your brain



## Section 1: Activity 5

1. Use arrows to indicate the direction of blood flow in the heart and the rest of the circulatory system.

*The right ventricle pumps blood to the lungs, and the left ventricle pumps blood to the rest of the body.*



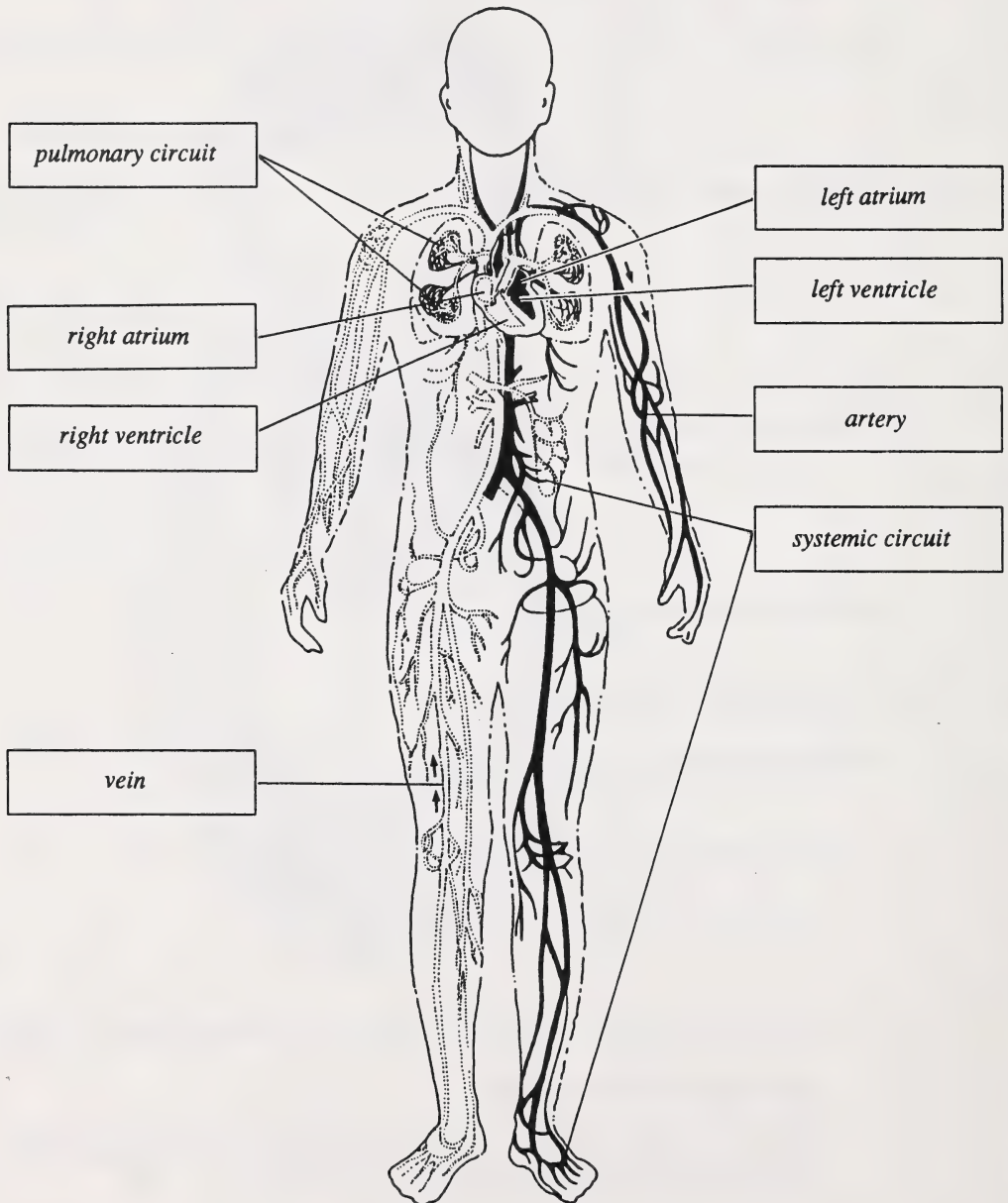
2. It is important that the oxygenated and deoxygenated blood do not mix in the heart.

Explain why this statement is true.

*Mixing the blood will reduce the amount of oxygen in the blood being pumped to the rest of the body. Your cells require high oxygen levels to function properly.*

3. Use the terms provided to label the diagram.

- vein
- artery
- right atrium
- left atrium
- right ventricle
- left ventricle
- pulmonary circuit
- systemic circuit





**Section 1: Activity 6**

1. a. Which glands are needed when you get into an emergency situation?

*The adrenal glands are needed for when you get into an emergency situation.*

- b. What do these glands do in an emergency?

*The adrenals give your entire body a chemical boost, preparing you to deal with the emergency.*

2. Name the appropriate reproductive glands and explain their function.

- a. male: *testis or testes (plural)*

*These reproductive glands produce sperm and stimulate the development of male secondary sex characteristics.*

- b. female: *ovary or ovaries (plural)*

*These reproductive glands produce eggs and develop female secondary sex characteristics. The ovaries also secrete hormones which maintain pregnancy and aid in childbirth.*

3. Name the two hormones secreted by the pancreas.

*Insulin and glycagon are the two hormones secreted by the pancreas.*

4. What is the target organ for insulin?

*The target organ is the liver.*

5. Which hormone would be released by your pancreas after you have just eaten a chocolate bar and consumed a soft drink? Explain why you would choose this hormone.

*Insulin would be released by the pancreas to reduce the level of glucose in your blood. Your blood sugar level would be rising as glucose from the soft drink and the chocolate bar entered your circulatory system.*

## Section 1: Follow-up Activities

### Extra Help

The following is a list of terms that you should know. Review the activities in Section 1 to find the meaning or function for each of these words.

*The functions or definitions for each term is as follows:*

**digestive system:** *the system within the body which converts food to fuel and raw materials that can be used by the body*

**hypothesis:** *an educated guess or good estimate; what you think the correct answer is*

**organ:** *a body part or group of tissues that does a specific function for the body*

**mouth:** *the opening through which food is taken in or ingested*

**esophagus:** *a muscular tube which moves food to the stomach*

**small intestine:** *a long tube where the absorption of nutrients occurs  
Chemicals are released by the small intestine that break down food into pieces that can easily be carried by the bloodstream to the rest of the body.*

**compact bone:** *hard, dense bone made of calcium and fibres*

**articulation:** *the point where two bones meet  
Usually some sort of bending occurs at the joint (articulation).*

**spongy bone:** *bone made of calcium but containing many narrow spaces giving it a spongy appearance*

**reaction time:** *the time it takes you to react to a situation*

**autonomic nervous system:** *the set of nerves which automatically control body functions such as breathing, heart rate, etc.*

**artery:** *a vessel that carries blood away from the heart*

**vein:** *a vessel that carries blood to the heart*

## Section 2: It's a Small World

The emphasis in this section is on how common life functions are shared by all living creatures. If students have access to a compound microscope, they should do the investigation using that microscope. A field trip to an institution with a scanning electron microscope would be appropriate for this section. Guest speakers could include microbiologists or zoologists studying various unicellular organisms.

### Section 2: Activity 1

#### Investigation: A Homemade Microscope

1. What happens to the letter *e* when you look at it through the lenses?

*The e gets larger and its image is inverted or flipped over.*



2. Turn this page upside down and look at the print through your microscope. Describe what you see.

*The print on the page will flip and appear right-side-up.*

#### Investigation: Use and Care of the Compound Microscope

3. Identify the part of the compound microscope which performs each of the following functions.

- a. holds down a slide:

*stage clips*

- b. keeps the lenses of the microscope the correct distance apart:

*body tube*

- c. holds the lower lens of the compound microscope:

*objective*



- d. controls the amount of light which passes through the object being examined:

*diaphragm*

4. In the following circle, draw the letter *e* as it appears through your microscope.

*At lower power the letter e would look something like the following diagram.*



*The e is not solid black and the edges are fuzzy. With a microscope you can see spots where the ink was not absorbed and spots where the ink ran slightly outside the boundaries of the letter e.*

5. Observe the letter *e* through the eyepiece and slowly move the slide to the right. When you do this, in which direction does the image seen through the eyepiece appear to move?

*The image moves to the left when you push the slide to the right.*

6. Centre the letter *e* in the field of view again. Now try moving the letter *e* away from you. In which direction does the image seen through the eyepiece move?

*The image moves toward you when you push the slide away from you.*

7. a. When the letter *e* is viewed at high power is the field of view (the area of the object that you can see) larger or smaller than at low power?

*The field of view is smaller at high power than at low power.*

- b. Does the brightness of the image seen through the microscope change when you switch from low power to high power?

*Yes, the image appears less bright, or dimmer, at high power.*

8. Can you see the entire letter *e* when looking at it through the high power objective?

*No, you cannot see the entire e when looking through the high power objective.*

Explain why or why not.

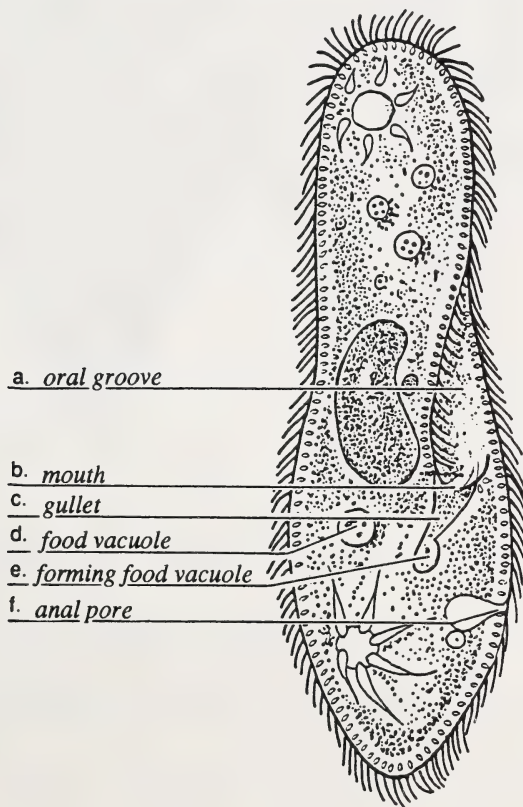
*The field of view becomes smaller as you switch from the low to the high power objective. When using the higher power objective for magnification you are actually looking at a smaller area under the microscope. The entire letter e does not fit into this smaller area.*

## Section 2: Activity 2

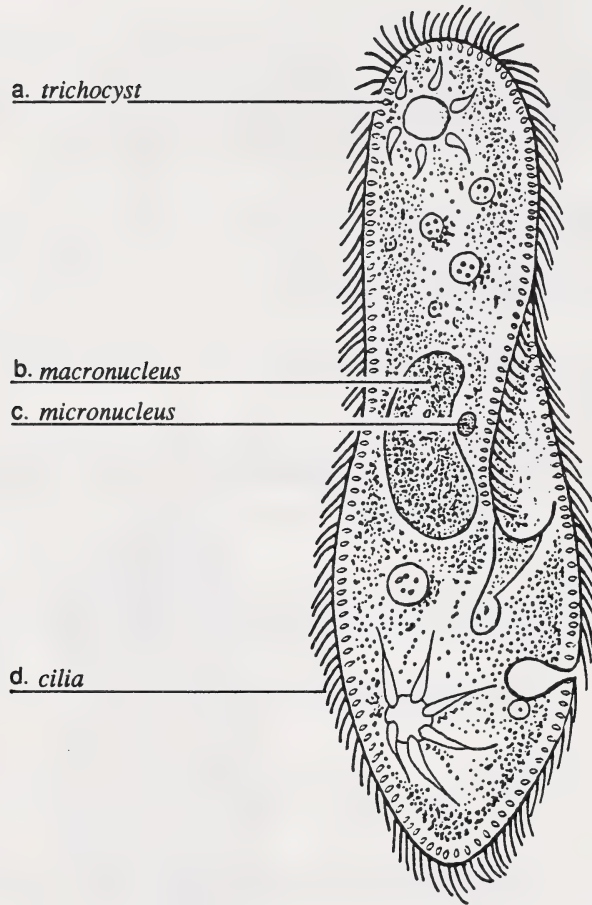
1. List your six important body systems.

*Your six important body systems are the muscle system, skeletal system, digestive system, circulatory system, nervous system, and the endocrine system.*

2. Match the function with the digestive **organelles** labelled in the *Paramecium* diagram.



3. Match the function with the organelles labeled in the *Paramecium* diagram.



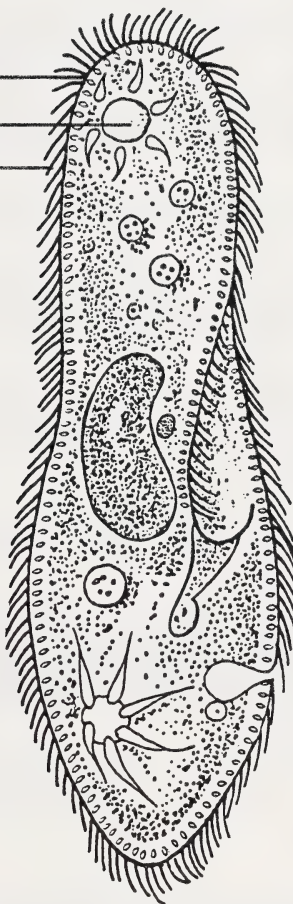


4. Match the functions with the organelles labelled in the *Paramecium* diagram.

a. pellicle

b. contractile vacuole

c. cilia



## Section 2: Follow-up Activities

### Extra Help

The following is a list of terms that you should know. Review the activities in Section 2 to find the meaning or function for each of these words.

*The functions or definitions for each term is as follows:*

**microscope:** a device consisting of two convex lenses which magnifies the object being looked at

**Paramecium:** *a single-celled organism that uses cilia to gather food and to move from one place to another*

**organelle:** *a specialized part of a cell that carries out a required function*

**food vacuole:** *the site for the digestion of food*

**macronucleus:** *the organelle which controls and regulates the day-to-day activities of the Paramecium*

**cilia:** *hair-like structures which wave to move the Paramecium and to move food into the mouth and gullet*  
*The cilia also provide a sense of touch for the Paramecium.*

**pellicle:** *the thick outer wall that gives the Paramecium its shape*

**contractile vacuole:** *the organelle which gathers and expels excess water out of the Paramecium*

**endoplasm:** *the fluid which circulates within the Paramecium to provide the nutrients needed by all organelles*

### **Module Summary**

A review of the various body systems using anatomy charts, life-size models of various organs or systems, or the human torso (and head) model is one way to culminate the module. You may also wish the student to examine various prepared microscope slides or microslides relating to human body structures or unicellular organisms.

## Key to the Assignment Booklet

### Section 1 Assignment (60 marks)

- (3 marks) 1. a. Describe the function of the earthworm's gizzard.

*The earthworm's gizzard starts digestion by using sand and muscular contractions to grind up food into smaller particles.*

- b. Name the organ of the human digestive system that performs the same function as the earthworm's gizzard.

*The human stomach initiates the chemical breakdown of food. Students may also name the teeth as the organ of digestion because of the grinding physical breakdown of food.*

- (3 marks) 2. Describe what actions take place and what systems are being used when you decide to bend your knee.

*Deciding to bend your knee means using your brain and nerves to stimulate your leg muscles (the hamstrings) to contract. The contraction pulls the lower leg upward, bending the knee.*

- (6 marks) 3. List the muscles used in throwing a ball. Practise going through the motions of throwing a ball so that you can feel the muscle or muscle group doing the action. You should refer to the "What's That Muscle?" activity to help you with your answer.

*The latissimus dorsi, biceps brachii, and deltoid work together to draw the arm back, preparing for the throw. The triceps, deltoid, and pectoralis major pull the arm forward when throwing the ball.*

- (3 marks) 4. Would it be possible for a person to continue living if one of their body systems stopped functioning? Explain why or why not.

*No, you cannot survive without all body systems functioning. Each body system depends on the others to function properly.*



- (15 marks) 5. Identify each of the organ systems in the illustrations and briefly explain how each system helps the next. The last system has been done for you.
- Endocrine System: releases hormones which can speed up or slow down your digestive system*
  - Digestive System: breaks down food so that it can be transported to the cells by the circulatory system*
  - Circulatory System: provides the nervous system with oxygen and nutrients and removes carbon dioxide and wastes*
  - Nervous System: stimulates and coordinates muscular contractions*
  - Muscular System: muscles attach to bones contracting to move the skeleton*
  - Skeletal system: The skeleton provides the basic framework for the body, keeping everything in its proper place.**
- (6 marks) 6. Explain what movement will occur with
- the contraction of muscle X  
*The contraction of muscle X will raise the lower leg, straightening the knee joint.*
  - the contraction of muscle Y  
*The contraction of muscle Y will raise the heel of the foot. If standing, the contraction of muscle Y will result in you standing on your tip-toes.*
- (4 marks) 7. Describe the changes that will occur to your breathing rate, heart rate, and circulatory system as you start to exercise.  
*Your breathing and heart rate will start to speed up. The circulatory system will work harder to transport the oxygen and nutrients necessary for the working muscle cells.*
- (4 marks) 8. Reaction times are the same for expected and unexpected events.
- Is this statement true or false?  
*false*

- b. Explain why you think that this statement is true or false.

*It takes longer to react to an unexpected event. Your body is not prepared to react to an unexpected event. You must sense the event, pass the information to the brain, decide on a course of action, and finally stimulate the muscles to react.*

- (6 marks) 9. Describe the levels of oxygen and carbon dioxide in blood flowing through each of the following parts of the circulatory system.

- a. left ventricle

*Blood in the left ventricle has just returned from the lungs, carrying high levels of oxygen and low levels of carbon dioxide.*

- b. right atrium

*Blood in the right atrium has been through the systemic circuit where it picked up increased amounts of carbon dioxide and released oxygen to the cells;  $\uparrow\text{CO}_2$  and  $\downarrow\text{O}_2$  in the blood.*

- c. capillaries of the systemic circuit

*Blood in the capillaries of the systemic circuit will release oxygen to the body cells and pick up carbon dioxide. Thus carbon dioxide levels increase while oxygen levels decrease.*

- (9 marks) 10. Name the endocrine organ and explain how it functions in each of the following cases.

- a. You have been fasting (going without food) for 24 hours.

*Pancreas: secretes glucagon to "unlock" the supplies of blood sugar in the liver and keep your blood sugar level constant*

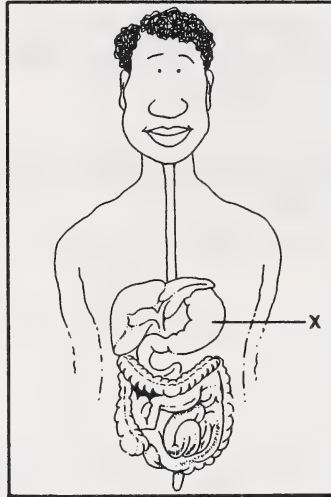
- b. You stop drinking milk and eating dairy products such as cheese.

*Parathyroids: regulate the amounts of calcium and phosphorus in the bloodstream  
A low intake of calcium and phosphorus means the release of hormones which will cause the break down of bone to obtain the calcium and phosphorus needed in the bloodstream.*

- c. You notice a car speeding straight toward you while you are crossing the street.

*Adrenal glands: provide energy for emergency situations and help the body adapt to stress and strain*

- (1 mark) 11. Identify the organ labelled X in the following diagram.



*The organ labelled X in the diagram is the stomach.*

### Section 2 Assignment (40 marks)

- (3 marks) 1. Explain how the microscope has aided in the study of the *Paramecium*.

*The microscope has allowed the world to observe and study organisms that cannot be seen with the naked eye. Studying how small organisms function helps you to increase your understanding of yourself.*

- (14 marks) 2. Name the structure or organelle of the *Paramecium* which performs the same function as that of the following human organs or structures. Explain why you chose each of the organelles.

- a. kidney

*Contractile vacuole: regulates the amount of water in the organism, like the kidney in a human*

- b. stomach

*Food Vacuole: stores and digests food*

*The forming food vacuole is also acceptable since it receives the food from the gullet, like the esophagus leading to the stomach of a human.*



- c. skeleton

*Pellicle: provides the Paramecium with a rigid shape, like the skeleton in a human*

- d. brain

*Macronucleus: controls and regulates the day-to-day activities of the organism, like the human brain*

- e. esophagus

*Gullet: provides a passageway for food to the regions where digestion will occur, like the esophagus in a human*

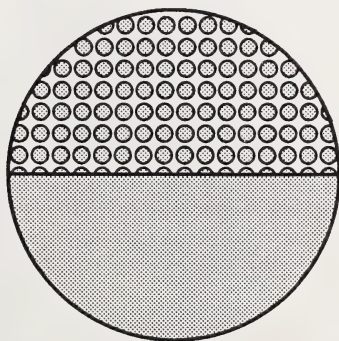
- f. blood

*Endoplasm: fluid that circulates oxygen and nutrients throughout the organism, like the blood in a human*

- g. anus

*Anal pore: the opening through which wastes are expelled from the organism, like the anus in a human*

- (6 marks) 3. a. Use your homemade microscope to examine a colour advertisement in a newspaper or magazine. Find a green portion of the advertisement and draw what you see. Label or describe your diagram.



*Students will see either rows of green dots or just an enlarged green area with no visible dots.*

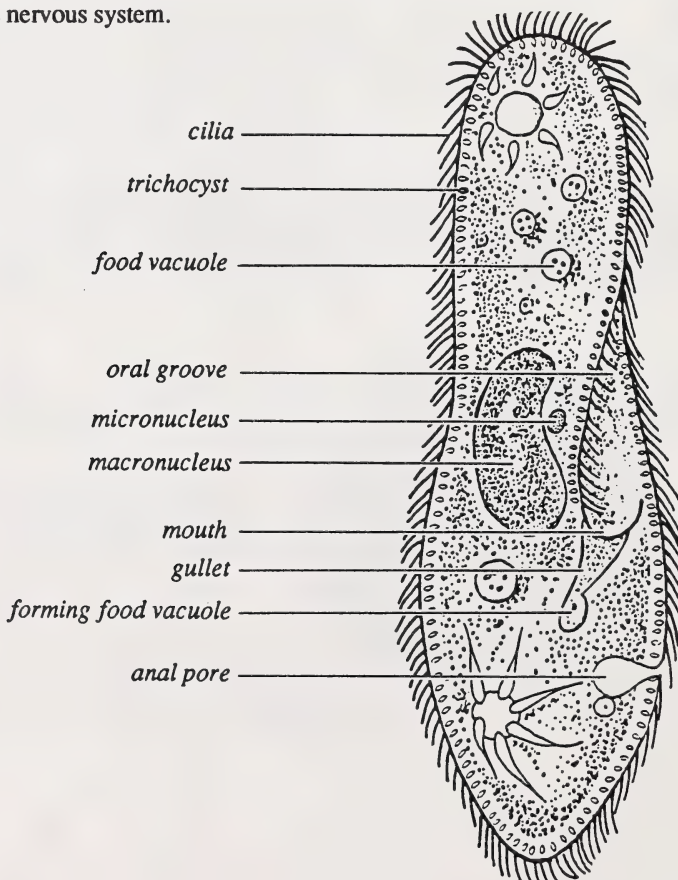
- b. Using the compound microscope found in most schools, a green portion of an advertisement will appear to be a mixture of yellow, blue, red, and possibly black dots. Does this match your observations with the homemade microscope? Explain your answer.

*The observations with the school microscope do not match those made with the homemade microscope. The homemade microscope does not have the resolving power necessary for the student to see the different coloured dots that are used to print the green portions of an advertisement. The student sees what appears to be green dots or green blotches on the paper.*

- (4 marks) 4. **Technology advances science.** Explain how this statement applies to the study of the *Paramecium*.

*The development of the compound microscope has allowed scientists to see and study the *Paramecium*. Improved microscope design has allowed scientists to study the organelles within the *Paramecium*. Technology (the microscope) has allowed for the gathering of knowledge (the advancement of science).*

- (13 marks) 5. Draw a diagram of a *Paramecium* and label the organelles which make up the digestive system and the nervous system.









This booklet cannot be purchased separately; the  
Learning Facilitator's Manual for Science 14  
is available only as a complete set.

